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The water supply system at Tuşpa (Urartu)

Günther Garbrecht

The principal purpose of a controlled water supply is to meet the demand for water in a certain region from locally available resources. However, water supply and demand are subject to different variations in the hydrological cycle, and these do not coincide in space or time. The quantity of water available is subject to considerable seasonal fluctuations and, in order to bring it into line with the personal and industrial needs of a society, it is necessary to make provisions for controlled hydraulic systems.

Seasonal problems can be solved by constructing natural or artificial reservoirs to store water in times of flooding in order to make it available during dry periods. The problem of distance between existing water resources and actual water consumption can be overcome by means of natural or artificial channelling.

The 'National Water Carrier' in Israel and the American 'California Water Project' are good examples of modern large-scale and long-term water supply systems, which have been rightly recognized and have received world-wide praise as superb technical achievements of our day. I should like to demonstrate, however, that not only the actual problems of water supply, but also the concept, planning and realization of such highly sophisticated systems have their predecessors in history. Furthermore, I am of the opinion that, with due respect for the technological limitations of the period, these ancient projects are comparable to modern installations. As an example, I would like to quote the irrigation and drinking water supply system at the Urartian capital of Tuşpa.

The earliest appearance of the name Urartu is in Assyrian inscriptions around 1250 B.C., indicating the geographical area between the lakes Van, Sevan and Urmia, where the frontiers of Turkey, Iran and the USSR meet (fig. 1). Harassed by the Assyrian campaigns to the north, the Hurrian tribes living in the Armenian highlands amalgamated around 850 B.C. to form the kingdom of Urartu. Their first king was Arame, who gave his name to the Armenians, the successors of the Urartians. During the reigns of thirteen successive kings between 850 and 600 B.C., during which constant battles were fought against the great power of Assyria, Urartu rose to a leading position in the Near East, but declined and eventually fell in 595 B.C. following an assault by the Scythians and Medes. The height of Urartian power was reached during the period between 830 and 730 B.C. (Albrecht 1972; Bilgiç 1966).

Evidence from Assyrian inscriptions, annals and commemorative records of victories, and from Urartian inscriptions and archaeological excavations indicates that the Urartian people were a nation with considerable artistic and technical skills. Special emphasis is

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repeatedly given to the remarkable hydrotechnical installations in Urartu, and numerous reservoirs, irrigation works and terracing are found all over the region (Burney 1972; Özgüç 1967).

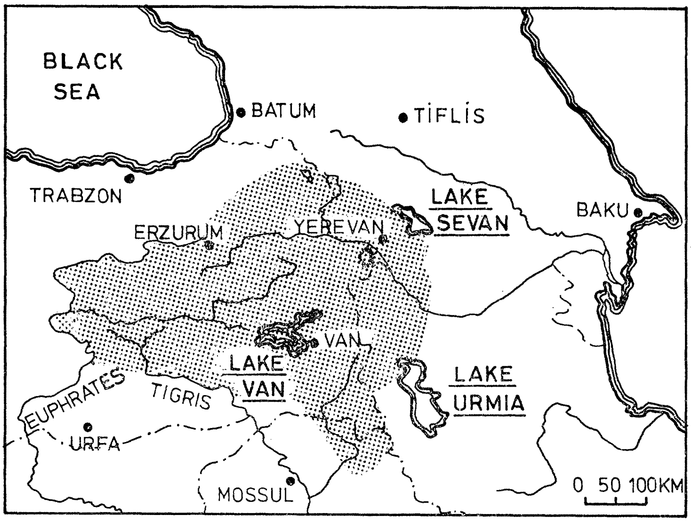

Figure 1 Kingdom of Urartu (850–600 B.C.)

In the district of Lake Van, low precipitation contrasts with high temperatures and high rates of evaporation during the growing season between May and September (table 1). The construction of intensive irrigation works was an essential precondition

TABLE 1

Temperature, precipitation and evaporation in the area of Van (Ögün 1970)

Months	*Mean temperature* (°C)	*Mean precipitation* (mm.)	*Mean evaporation* (mm.)
January	−4·0	41·9	–
February	−3·0	34·8	–
March	−0·2	47·3	–
April	7·1	58·4	32·8
May	13·0	41·1	109·9
June	18·0	16·8	210·6
July	22·1	6·0	320·2
August	21·8	3·1	308·9
September	17·2	10·0	192·3
October	10·5	41·1	71·7
November	4·8	49·3	15·0
December	−1·0	29·3	–
Total	–	379·1	1261·4

for the development of a flourishing civilization in the densely populated areas of the alluvial valleys in this highland region. It appears that the Urartians were the only people in the Near East to evolve a concept of elaborate and well-planned water supply systems which are reminiscent of modern hydraulic works and can stand comparison with the great systems and installations of Mesoptoamia and Egypt.

The water supply system of the royal capital of Tuşpa will be described here. Tuşpa, the modern town of Van, was chosen by Sardur I, around 830 B.C., to be his capital (fig. 2). The water of Lake Van is not drinkable, because of its high sodium carbonate

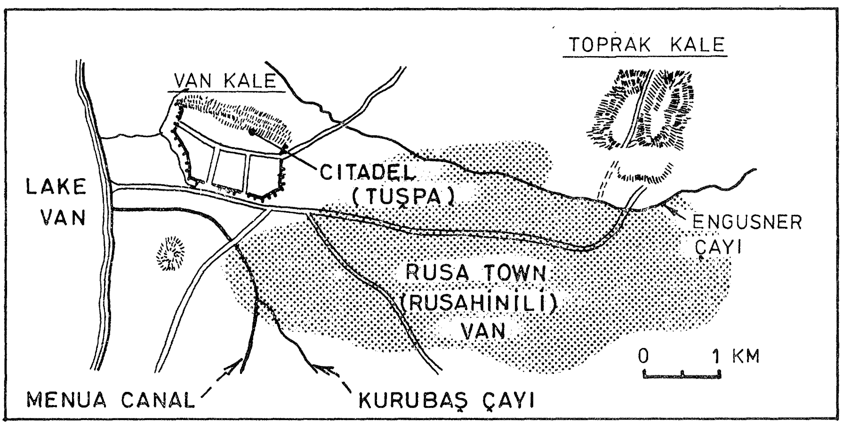

Figure 2 Van Kale (Tuşpa) and Toprak Kale (Rusahinili), capitals of the Kingdom of Urartu

content, and the two streams of Engusner Cayi and Kurubas Cayi, both of which flow into the plain of Van, do not carry water all the year round. In order to provide a secure and stable water supply to meet the demands of the population and of agriculture, it was necessary to exploit resources farther away. A powerful spring in the neighbouring valley of the Engil Cayi river and the natural reservoir of the Kesis Gölü provided the convenient resources (fig. 3).

The Menua canal

The Urartian engineers first exploited the spring in the valley of the Engil Cayi, at a distance of about 56 km. from Tuşpa. Its average flow is 2–3 $m.^3/s$, and does not fall below 1·5 $m.^3/s$ even during the dry season. In its natural course, the water from the spring flows into the Engil Cayi, about 5 km. away; but it was collected – as it still is today – immediately below the spring by means of simple stone and earth works, and channelled across the Engil Cayi to its right shore. The aqueduct, today a concrete structure, consisted right up to the end of the last century of tree trunks with a primitive packing, and it is reasonable to assume that the system was similar in Urartian times (Lehmann-Haupt 1926: Ögün 1970).

In general, it is difficult to date ancient water systems as they do not usually produce coins, pottery or other aids to chronology. However, the canal supplying water to Tuşpa

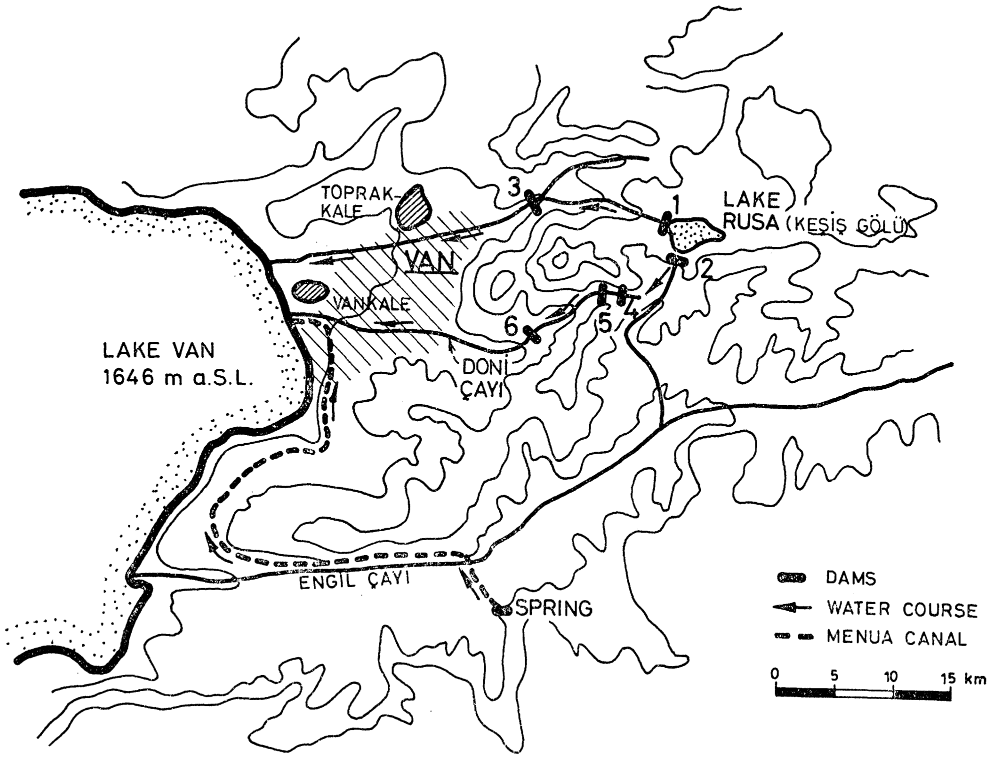

Figure 3 Water supply of Tuşpa (Van)

is an exception, for there are fourteen inscriptions along the course of the canal which tell us that King Menua constructed it. According to Assyrian traditions, he reigned between 805 and 785 B.C. These inscriptions always occur at places of particular constructional difficulty, and they consist of 14, 9, 4 or 3 lines, depending on whether they include the 'curse formula' or not (plate 6). At the point where the aqueduct takes the water across the Engil Cayi, there is a complete commemorative tablet of 14 lines. It states the following in both Urartian and Assyrian cuneiform (König 1955):

> Through the power of Haldi, Menua, the powerful king, the great king, the king of Bihai-Lands, the Lord of the city of Tuşpa has directed this canal. Its name is Menua canal. . . . He who dares to obliterate this inscription or damage it . . . or he who dares to say 'I have directed this canal', will be exterminated by Haldi, god of weather and sun, and by the other gods; he will be removed from the light of the sun . . . and his life will be destroyed and made into nothingness.

After the aqueduct, the canal follows the course of the Engil Cayi along the northern slopes of the valley in a westward direction, and flows increasingly farther away from the river, due to the very slight gradient (fig. 3). Initially the historical canal is identical with the modern one, but then the modern course deviates from the ancient course for reasons of practical economy. Thanks to the old retaining walls, which still exist, it is possible to reconstruct the whole course of the Urartian canal in complete detail (plate 7).

About 25 km. below the spring, the course of the canal turns northwards and follows

along the eastern shore of Lake Van (fig. 3). The terrain here presents a number of obstacles, in that several narrow valleys have to be skirted, and rocky areas, as well as stone-swept slopes, must be traversed. The size of the retaining walls increases in proportion to these obstacles, and in certain cases reaches a height of 20 m. Everywhere the inscriptions confirm that it was King Menua who built the canal (plate 6).

After a run of about 56 km., the canal reaches the plain of Van-Kale, irrigating the gardens and fields of the city of Van, as it did, centuries ago, for Tuşpa. For the last 10 km. approximately, the historical and modern canals are again identical. With a mean water flow of 2·5 m.^{3}/s, a total of $75 . 10^6$ m^3. was channelled annually, and, because of the steady supply of the spring, storage was not necessary.

In its original shape and course, and with its Urartian structures, the Menua canal has flowed uninterruptedly for 2,500 years. It was only in 1950 that the middle part of it had to be replaced by a modern concrete channel as the maintenance of the old one became too costly.

Water storage in Lake Rusa

Around the year 700 B.C., the capital of the kingdom was moved from Van-Kale to Toprak-Kale (fig. 2). But the ancient citadel, with its gardens and fields, was not abandoned, and the Menua canal continued to bring water to Tuşpa. Thus, the question arose of how to supply water to the new royal capital and its surroundings. The clue as to date, concept of planning, and carrying out of the water supply project was found on the gigantic stela discovered by W. Belck at the end of the last century, in the surrounding hills of the Kesis Gölü, situated about 30 km. away, and 900 m. higher than Toprak-Kale (König 1955):

I. . . . Mountains, massive quantities of water I dammed here for canals and flows; I decided its name to be Lake Rusa. I directed a canal from here to the city of Rusahinili, and for the land which was later to be cultivated, but which had previously remained uncultivated. Land suitable for orchards and wilderness areas was not used in those days.

II. Rusa says: When I had founded Rusahinili, when I had built this artificial lake (with its dams), I decreed . . . the future land in front of the city of Rusahinili and the cultivable land by the lake . . . which was uncultivated and neglected, should . . . be made completely arable.

III. Rusa says: For the future (thus created) land I decreed vineyards, orchards and vegetable gardens; I created great works there. This artificial lake is the water supply for Rusahinili, and all work will produce richness, as I helped the city of Rusahinili . . . by directing great quantities of water from the reservoir and . . . channelling them from the Alaini river to Rusahinili. With regard to the water which is to be brought from the Alaini river to Tuşpa, it should also be directed to Rusahinili as an additional water supply.

Rusa thus achieved the following (it is debatable whether it was Rusa I, who reigned 730–714 B.C., or Rusa II, about 685–645 B.C.):

(a) he transformed the flat water basin of the Kesis Gölü into an artificial lake by damming it at its natural outlets

(b) he directed the water from here to his new capital of Rusahinili (= Rusa city)
(c) he made the land around Rusahinili arable, and planned irrigated orchards and vegetable gardens
(d) he re-directed the water from the river Alaini (to Tuşpa) to Rusahinili as an additional water supply.

Like the Menua canal, this Urartian water storage and canal system (fig. 3) was partly or wholly in use for a period of 2,500 years. It was not until 1891 that the north dam (1) collapsed through flooding, after a winter of very hard snows followed by an extremely wet spring. The main reason for the disaster was probably the fact that the outlet passage through the 6 m. high south dam (2) was no longer functioning. Lehman-Haupt (1926) found it actually closed from upstream, tamped with earth. The closing device (probably a wooden or stone gate) was missing. As there was unusually much water during 1891, the opening for the discharge in the north dam was not big enough for the amount of water, and thus the structure was destroyed.

The north dam (1), which, in its original form, was probably higher, was rebuilt in 1894–5 to a height of only 3 m., and again (in 1952) to a height of 5·40 m. (plate 8). The outlet today is $0{\cdot}65 \times 0{\cdot}65$ m.^{2} in size, and is capable of discharging 2·5–3 m.^{3}/s.

The water from the north dam ran through the valley of the Engusner Cayi directly to the garden town of Rusahinili. It is not known whether the dam (3) situated half way between the lake and the city (and called 'Faruk Bendi' today) is of Urartian origin or is a later construction (fig. 3).

The south dam consists of two dry walls, each 7 m. wide, with a core of earth in between (plate 9). It was about 6 m. high, 27 m. wide and 62 m. long. Its drainage was through an opening, closable from upstream, of $0{\cdot}27 \times 0{\cdot}95$ m.^{2} The situation and elevation of this structure indicate that the level of the lake in Urartian times was up to 10 m. higher than today, which in turn means that the destroyed north dam must have been considerably higher in Urartian times than it is now after renovation. The maximum volume contained by the lake today is roughly $20 \,.\, 10^6$ m.^{3}, and was probably more in the region of $100 \,.\, 10^6$ m.^{3} in ancient times, of which more than half was utilized.

Flow through the south dam (2) would normally reach Lake Van via the valley of the Engil Cayi. In order to utilize this water also for the plain of Tuşpa–Rusahinili, the passage through the south wall was redirected into the drainage area of the Doni Cayi (present-day name of the lower river: Kurubas Cayi). Apparently there were as many as ten small reservoirs in the valley of the Doni (Ögün 1970), of which three are wholly or partly preserved (fig. 3). The two reservoirs located upstream (4 and 5) are still in use today for the storage of irrigation water for the Van plain (plate 10). Further study is necessary in order to determine which of the ten dams belong to the Urartian period.

The water supply system of Urartian Tuşpa is an excellent example of a well-planned and superbly realized large-scale hydrotechnical project, which has demonstrated its capacity to resist the destructive powers of nature (decay, earthquake) and of human disasters (warfare), and is still productive today.

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Abstract

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The water supply system at Tuşpa (Urartu)

Modern hydraulic installations differ only in their dimensions, but not in their principles, from water supply projects of antiquity. The supply of the Urartian capital, Tuşpa (850–600 B.C.) with drinking and irrigation water by means of dams and canals is an outstanding example of thoughtful planning and excellent workmanship. The system has been in operation for more than 2,500 years, and still serves, at least partly, its original purpose.